Region 10, 1200 Sixth Avenue, Seattle WA 98101

COLUMBIA RIVER BASIN FISH CONTAMINANT SURVEY

VOLUME I
Appendix M

Hazard Indices Across Study Sites

July 2002

Prepared by
U.S. Environmental Protection Agency
Region 10
Seattle, Washington

M.1 Comparison of Hazard Indices Across Sites and Among Species

Non-cancer hazards were estimated for fish collected in the Columbia River Basin as described in Section 6. Graphical representations of the data are presented in this section to show hazard indices for multiple species, sample types, and sites.

To show the greatest number of hazard indices, the scenario that generates the highest risk estimates - a CRITFC's member tribal child with a high fish consumption rate (162 g/day) - was chosen to compare estimates among species and sampled sites. Total hazard indices are shown for all fish species. In addition to total hazard indices, endpoint specific hazard indices which exceeded 1.0, are shown for the liver health endpoint, the central nervous system health endpoint, the immune system health endpoint, and the reproduction/development health endpoint. These four health endpoints are presented because they tended to have the highest hazard index values and exceeded 1.0 in the most fish species for a CRITFC's member tribal child with a high fish consumption rate.

M.1.1 Resident Fish Species

Samples of six resident fish species—bridgelip sucker, largescale sucker, mountain whitefish, white sturgeon, walleye, and rainbow trout—were collected from the following sites in the Columbia River Basin:

- Site 6 - located in the Columbia River between the Bonneville Dam and the Dalles Dam
- Site 7 - located in the Columbia River between the Dalles Dam and the John Day Dam
- Site 8 - located in the Columbia River between the John Day Dam and the McNary Dam
- Site 9L - located in the upper Columbia River below the Snake River
- Site 9U - located in the upper Columbia River above the Snake River
- Site 56 - located in the Klickitat River
- Site 98 - located in the Deschutes River
- Site 30 and 101 - located in the Umatilla River
- Site 48 and 49 - located in the Yakima River

Total hazard indices and hazard indices for four health endpoints for the six resident fish species are presented in Figures 6-1 through 6-10. Note that the hazard index scales on the Y axes differ, ranging from 0.1 to 100 for the endpoints for central nervous system, reproduction/developmental, and liver, and from 0.1 to 1000 for the endpoint of immunotoxicity and for total hazard index.

It is difficult to draw conclusions from these figures because different species were sampled at different locations. However, it appears that for the endpoint specific hazard indices for liver and the immune system and for total hazard indices for a given species, some sites (e.g., 56, 98, 30 and 101) tend to have lower values than the other sampled sites. The central nervous system and reproduction/development health endpoints did not show as much of a trend. This may be because

these health endpoints are driven by concentrations of mercury, which appear to be more evenly distributed among the fish tissues collected within the Columbia River.

Total Hazard Indices

Total hazard indices for the CRITFC's member tribal child with a high fish consumption rate (162 g/day) ranged in value from 15 for whole body rainbow trout at site 101 to a high of 290 for fillet without skin samples of white sturgeon at site 9U. White sturgeon at Sites 9L and 9U and mountain whitefish at Site 48 had the highest total hazard indices in fillet samples (Figure 6-1). The highest total hazard indices in whole-body samples occurred for walleye at Site 7; white sturgeon at Site 8, 9L, and 9U; mountain whitefish at Site 9U and Site 48; and largescale sucker at Site 9U and Site 48 (Figure 6-2).

Liver Health Endpoint

Hazard indices for the liver health endpoint ranged from a low of 1 for rainbow trout at site 101, whole body samples, to a high of 41 for white sturgeon, fillet without skin samples, at site 9U. The highest hazard indices for the liver health endpoint in fillet samples occurred for white sturgeon at all Columbia River sites and Site 13, mountain whitefish at Site 9U and Site 48, and largescale sucker at Site 48 (Figure 6-3). The highest hazard indices for the liver health endpoint in whole-body samples occurred for largescale sucker at Site 9U and Site 48; white sturgeon at Sites 8, 9L, and 9U; mountain whitefish at Site 48, and walleye at Site 7 (Figure 6-4).

Central Nervous System Health Endpoint

Hazard indices for the central nervous system health endpoint ranged from a low of 4.3 for mountain whitefish fillets at site 8 to a high of 39 for largescale sucker fillets at site 13. The highest hazard indices for the central nervous system health endpoint in fillet samples occurred for largescale sucker at Sites 9U, 30, 13, 48, 49; white sturgeon at all Columbia River sites and Site 13; walleye at Site 30; and mountain whitefish at Site 48 (Figure 6-5). The highest hazard indices for the central nervous system health endpoint in whole-body samples, occurred for largescale sucker at Sites 8, 9U, 98, 13, 48, 49; walleye at Site 7 and Site 30; white sturgeon at Site 8 and Site 9L; and rainbow trout at Site 98 (Figure 6-6).

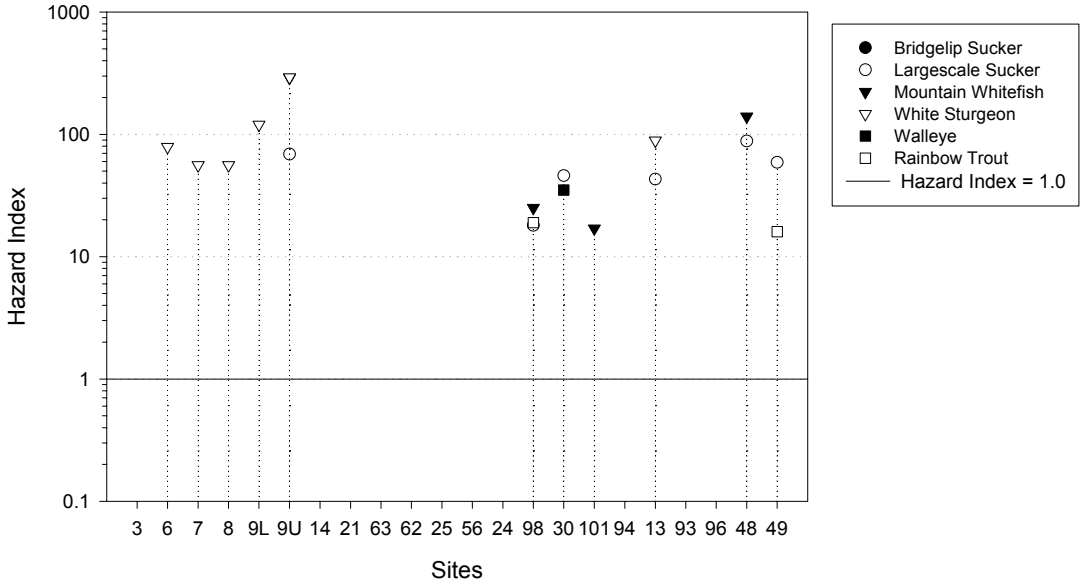

Figure 6-1. Total hazard indices in fillet samples of resident fish species by site

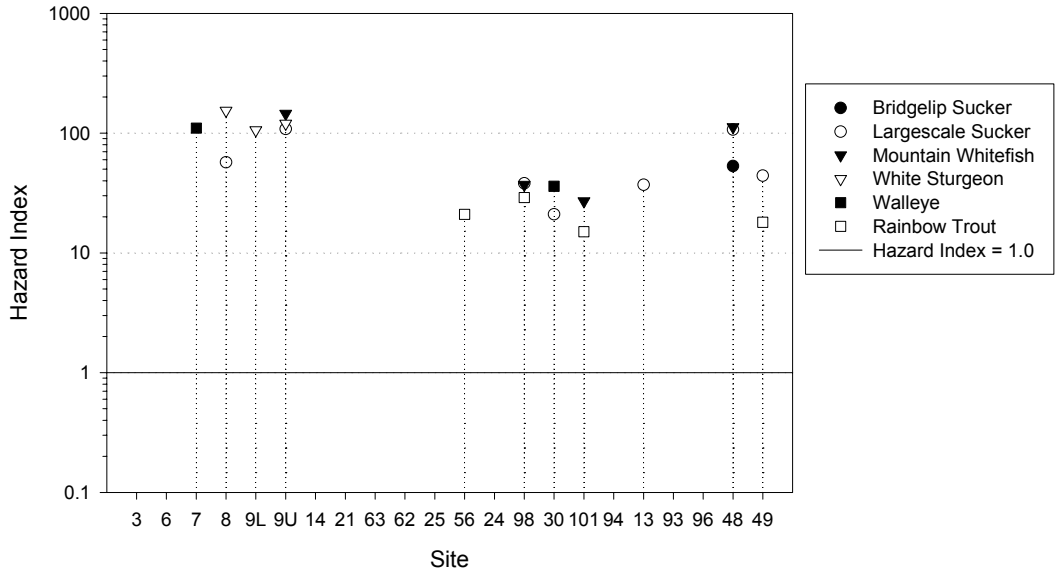

Figure 6-2. Total hazard index in whole body samples of resident fish species by site

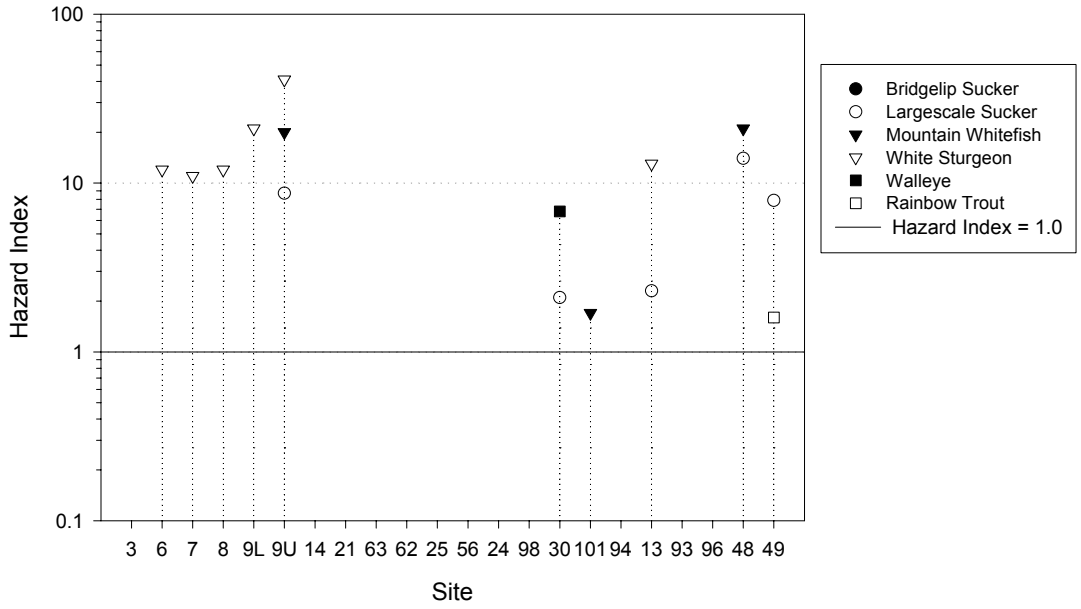

Figure 6-3. Hazard indices for the liver health endpoint in fillet samples of resident fish species by site

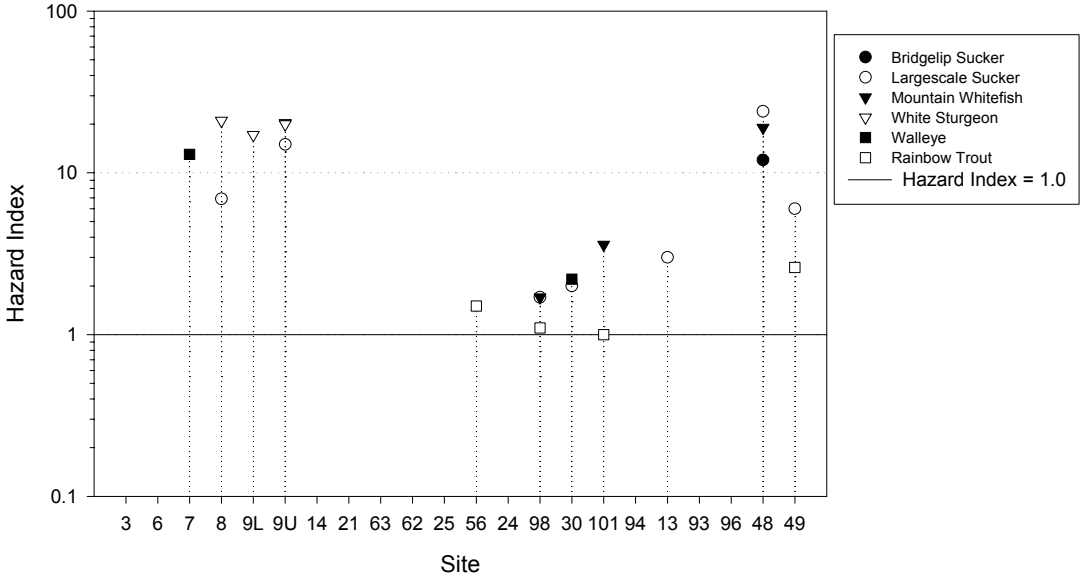

Figure 6-4. Hazard indices for the liver health endpoint in wholebody samples of resident fish species by site

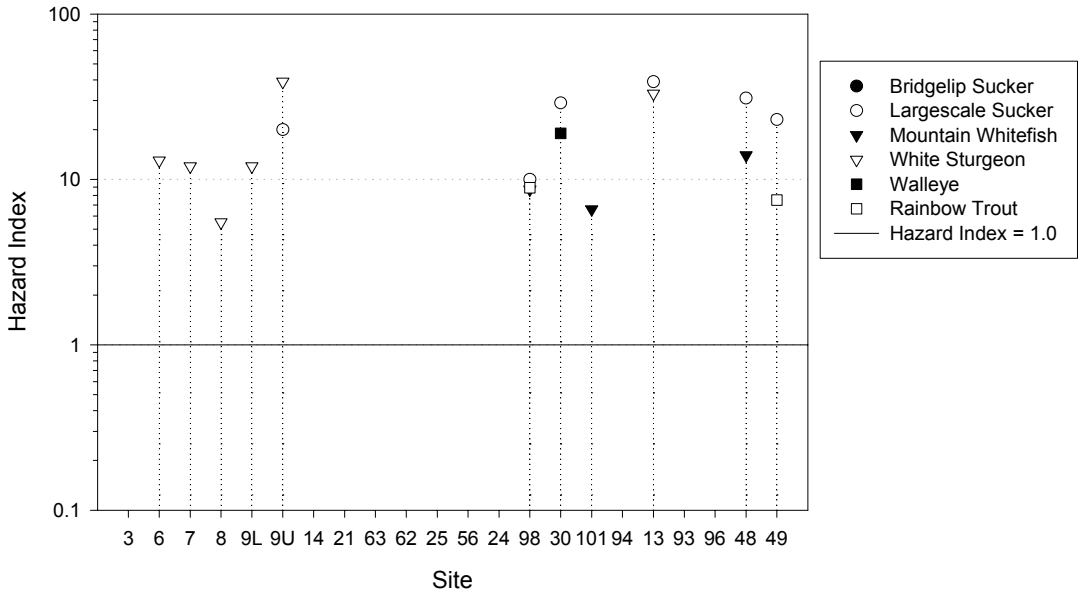

Figure 6-5. Hazard indices for the central nervous system health endpoint in fillet samples of resident fish species by site

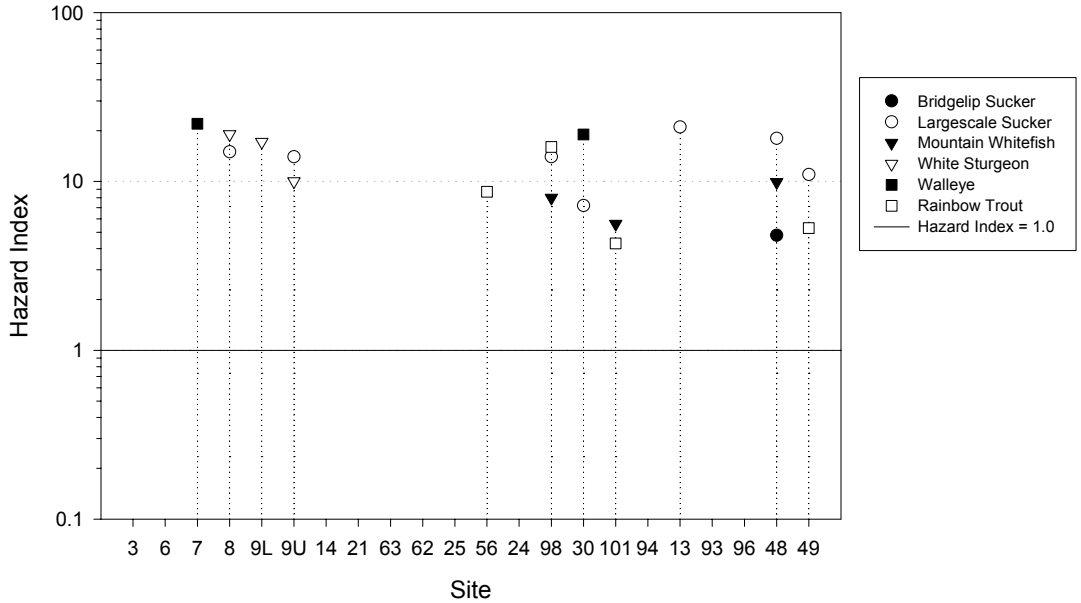

Figure 6-6. Hazard indices for the central nervous system health endpoint in whole body samples of resident fish species by site

Immune System Health Endpoint

Hazard indices for the immune system health endpoint ranged from 4.8 for whole body rainbow trout samples at site 101 to a high of 270 for mountain whitefish at site 9U. The highest hazard indices for the immune system health endpoint in fillet samples for mountain whitefish were at Site 9U and 48 and for white sturgeon at Site 9U (Figure 6-7). The highest hazard indices for the immune system health endpoint in whole-body samples occurred for mountain whitefish at Site 9U and white sturgeon at Site 8 (Figure 6-8).

Reproduction/Development Health Endpoint

Hazard indices for the reproduction/development health endpoint are similar to those for the central nervous system. The highest hazard indices for the reproduction/development health endpoint in fillet samples occurred for largescale sucker at Sites 9U, 30, 13, 48, 49, and 98; white sturgeon at Sites 6, 7, 9L, 9U, and 13; walleye at Site 30, and mountain whitefish at Site 48 (Figure 6-9).The highest hazard indices for the reproduction/development health endpoint in whole-body samples occurred for walleye at Site 7 and Site 30; white sturgeon at Site 8 and Site 9L, largescale sucker at Sites 8, 9U, 98, 48, and 49; and rainbow trout at Site 98 (Figure 6-10).

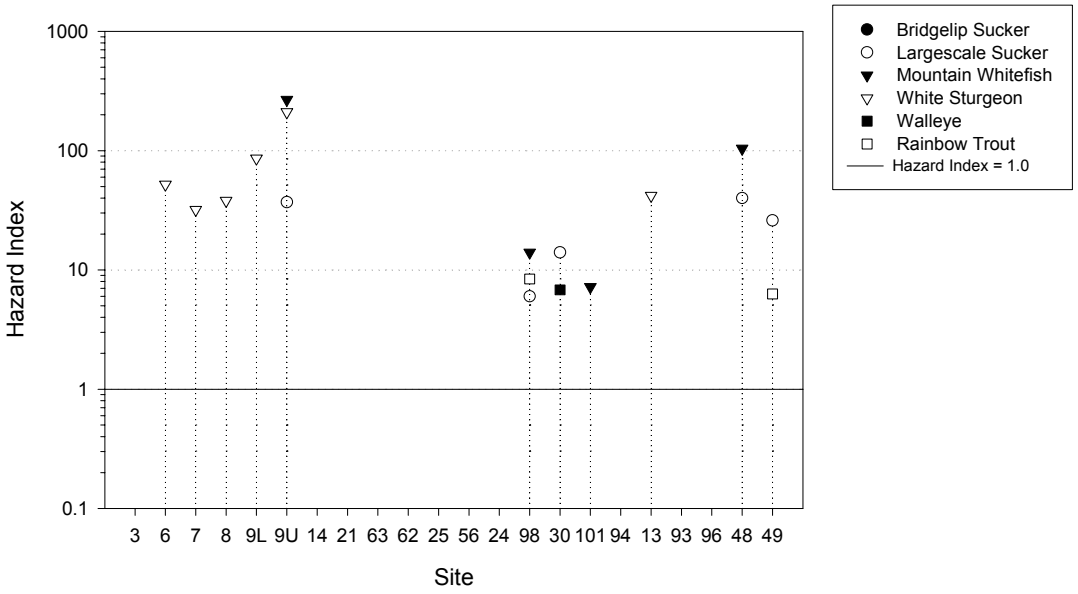

Figure 6-7. Hazard indices for the immune system health endpoint in fillet samples of resident fish species by site

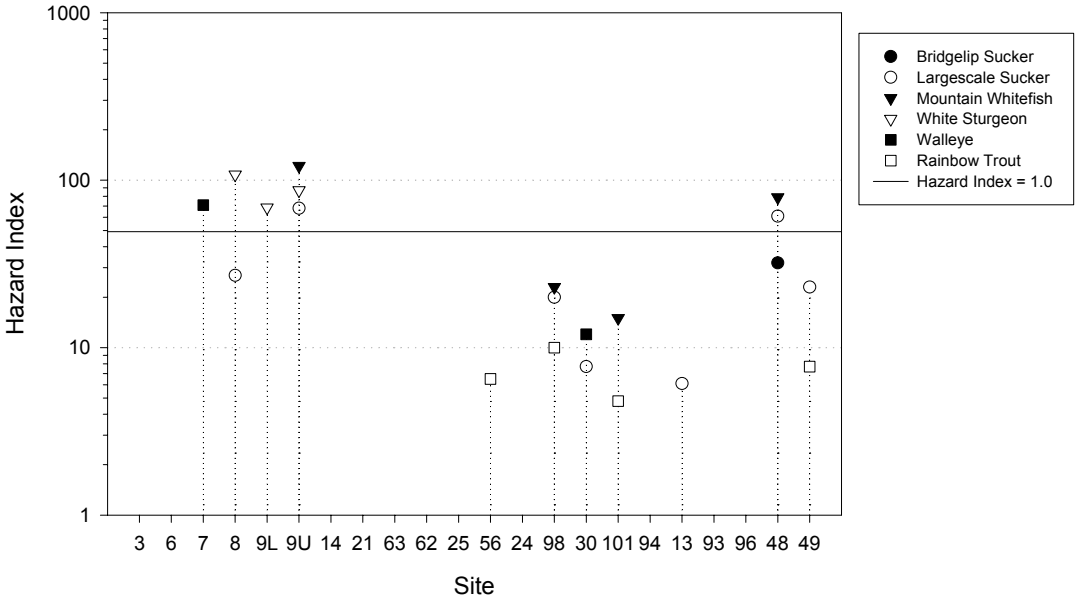

Figure 6-8. Hazard indices for the immune system health endpoint in whole body samples of resident fish species by site

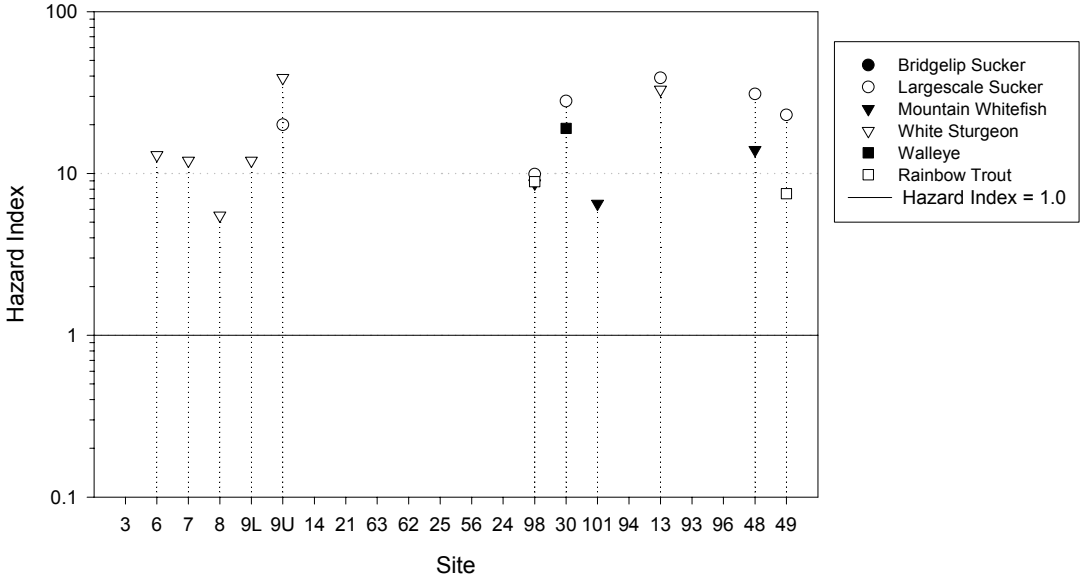

Figure 6-9. Hazard indices for the reproduction/development health endpoint in fillet samples of resident fish species by site

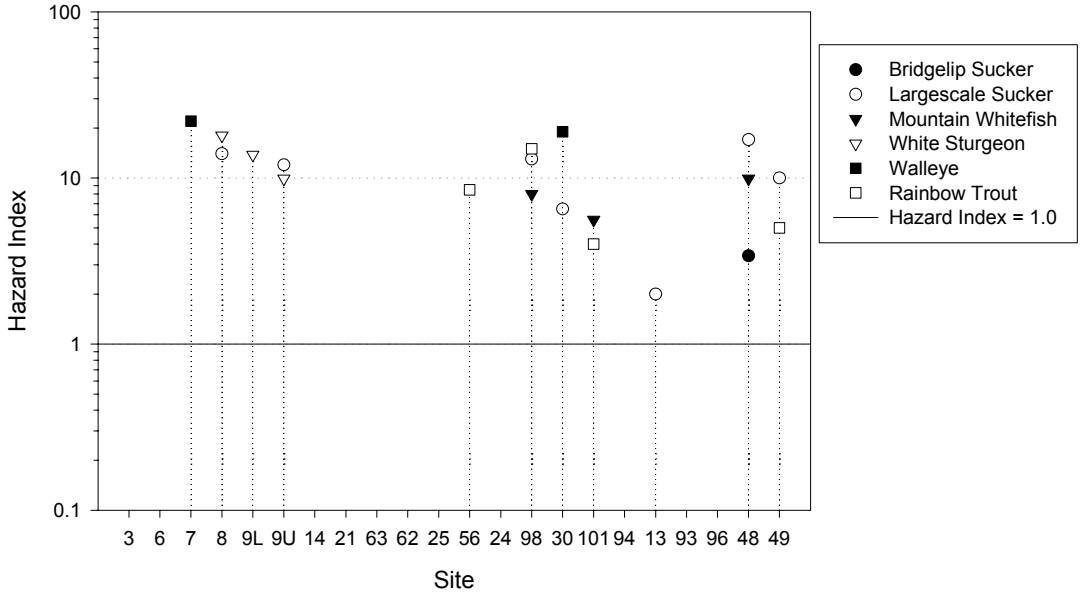

Figure 6-10. Hazard Indices for the reproduction/developmental health endpoint in whole body samples of resident fish species by site

M.1.2 Anadromous Fish Species

Samples of anadromous fish, coho salmon, fall chinook salmon, spring chinook salmon, steelhead, eulachon, and Pacific lamprey, were collected from the following sites in the Columbia River Basin:

- Site 8 - located in the Columbia River between the John Day Dam and the McNary Dam
- Site 14 - located in the upper Columbia River above the Snake River
- Site 21 - located in the Willamette River
- Site 63 - located in the Wind River
- Site 62 - located in the Little White Salmon River
- Site 25 - located in the Hood River
- Site 56 - located in the Klickitat River
- Site 24 - located in Fifteen Mile Creek
- Site 98 - located in the Deschutes River
- Site 30 - located in the Umatilla River
- Site 93 - located in the Snake River
- Site 96 - located in the Clearwater River
- Site 48 - located in the Yakima River
- Site 51 - located in the Wenatchee River

Total hazard indices and hazard indices for four health endpoints for the anadromous fish species are presented in Figures 6-11 through 6-20. In general, total hazard indices, liver health endpoint hazard indices, and immune system health endpoint hazard indices were much lower in most anadromous fish species compared to most of the resident fish species. Hazard indices for the central nervous system and reproduction/development health endpoints were similar in magnitude between anadromous and resident fish species.

Total Hazard Indices

Total hazard indices ranged from a low of 8.6 in whole body eulachon to a high of 99 in whole body Pacific lamprey at site 24. The highest total hazard indices in fillet samples occurred for Pacific lamprey at Site 21 (Figure 6-11). The highest total hazard indices in whole-body samples, occurred for Pacific lamprey at Site 24 (Figure 6-12).

Liver Health Endpoint

Hazard indices for the liver health endpoint in anadromous fish species were all less than 10. The highest hazard index for the liver health endpoint occurred for Pacific lamprey at Site 21 (Figure 6-13). The highest hazard indices for the liver health endpoint in whole-body samples occurred for Pacific lamprey at Sites 21 and 24 (Figure 6-14).

Central Nervous System Health Endpoint

Hazard indices for the central nervous system health endpoint in anadromous fish ranged from a low of 4.2 for whole body fall chinook at site 56 to a high of 33 for spring chinook fillet at site 56. The highest hazard indices in fillet samples occurred for spring chinook salmon at Sites 56 and 51 and fall chinook salmon at Site 14 (Figure 6-15). The highest hazard indices in whole-body samples occurred for steelhead at Site 93 and Site 96, Pacific lamprey at Site 24, coho salmon at Site 30, and spring chinook salmon at Site 56 (Figure 6-16).

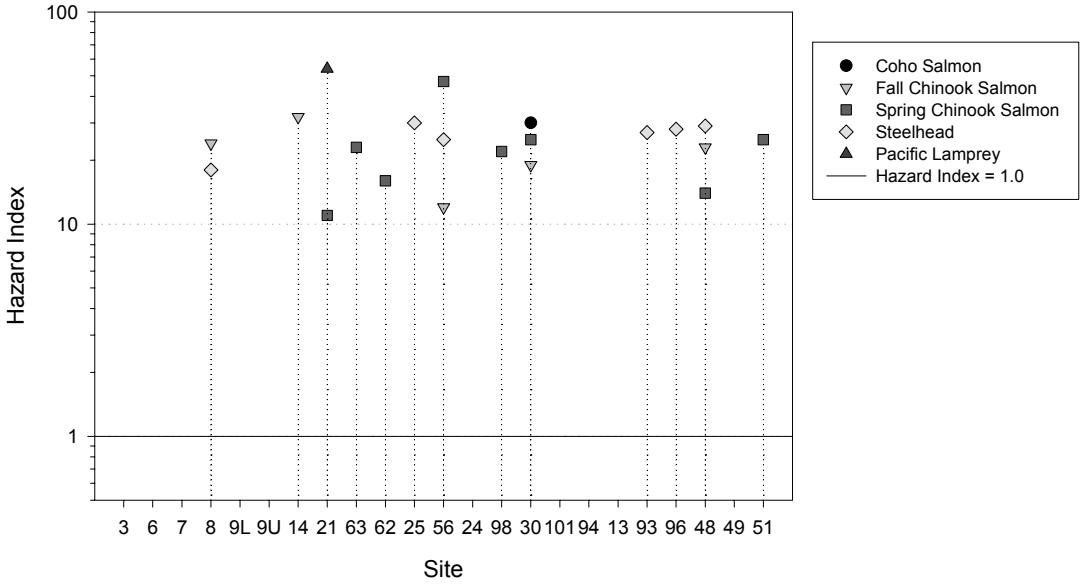

Figure 6-11. Total hazard index in fillet samples of anadromous fish species by site

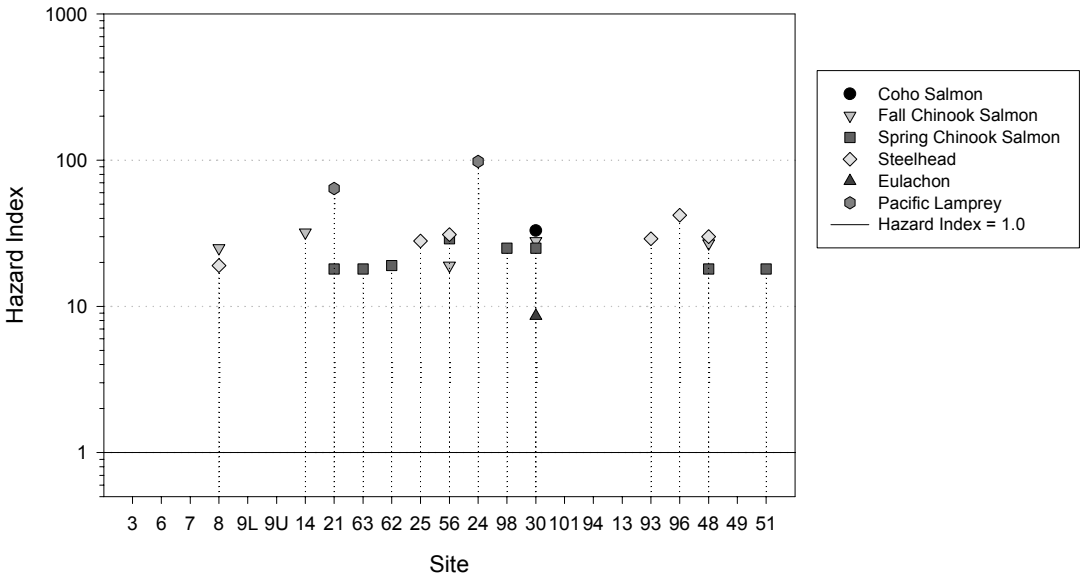

Figure 6-12. Total hazard index in whole body samples of anadromous fish species by site

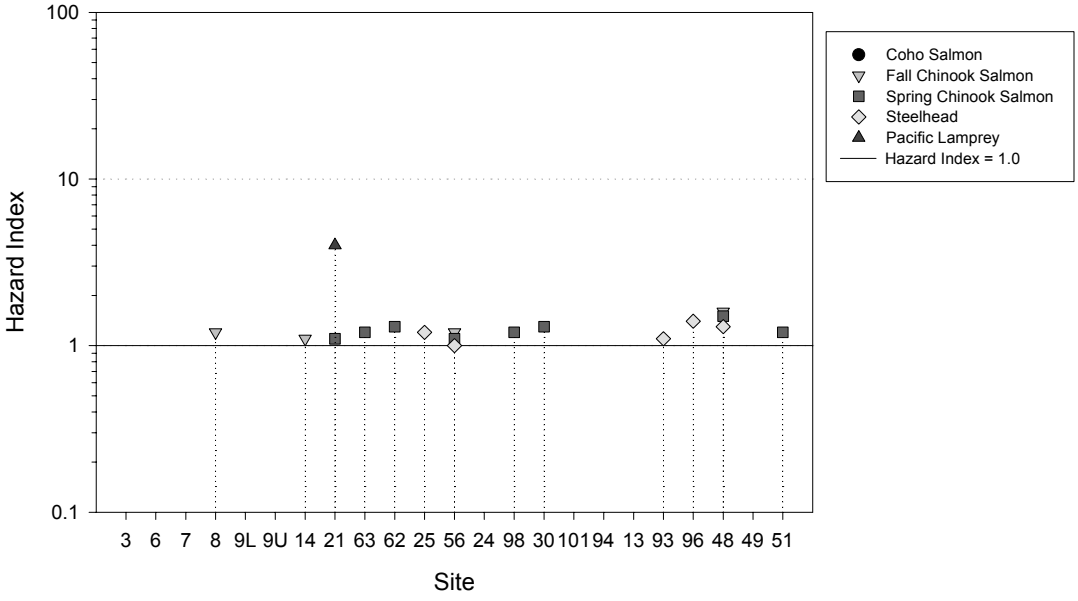

Figure 6-13. Hazard indices for the liver health endpoint in fillet samples of anadromous fish species by site

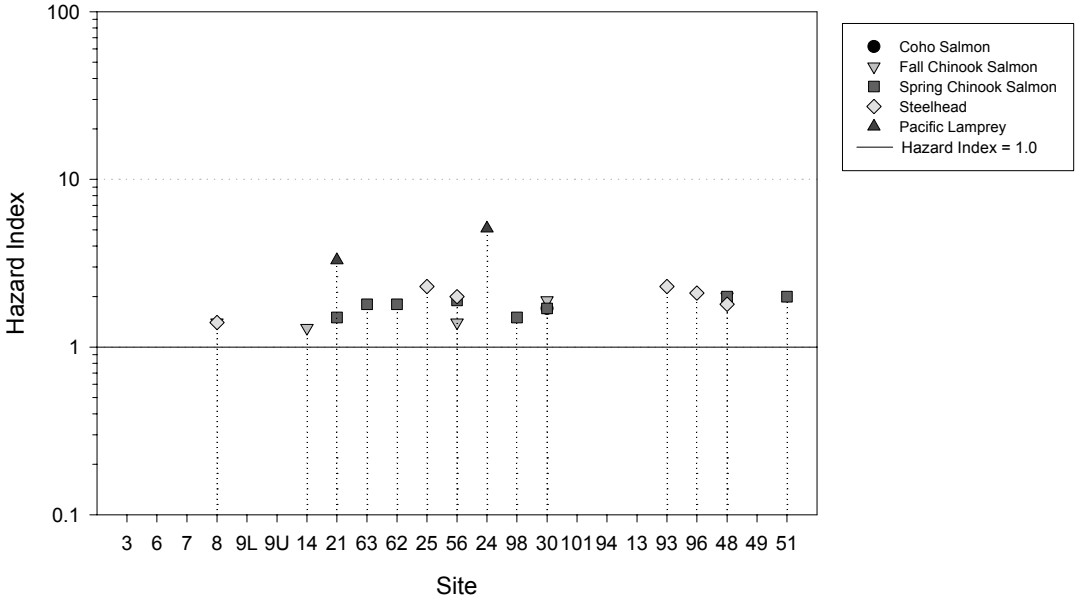

Figure 6-14. Hazard indices for the liver health endpoint in whole body samples of anadromous fish species by site

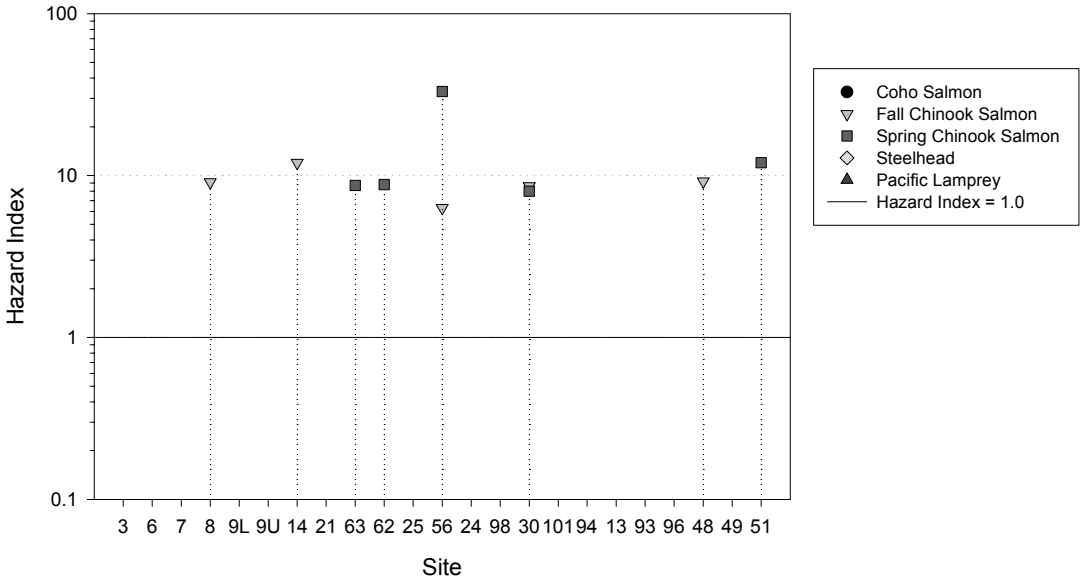

Figure 6-15. Hazard indices for the central nervous system health endpoint in fillet samples of anadromous species by site

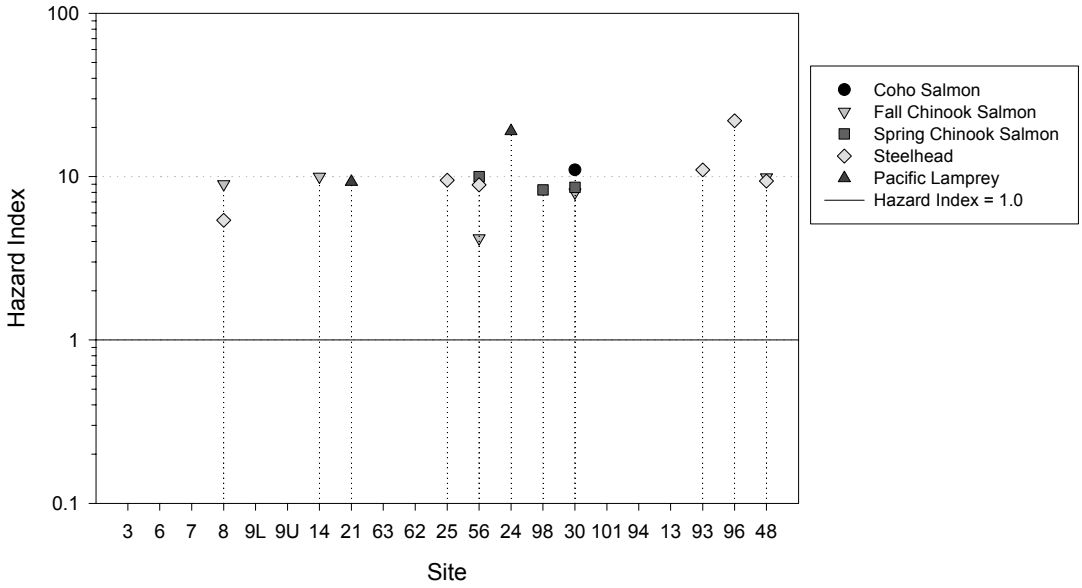

Figure 6-16. Hazard indices for the central nervous system health endpoint in whole body samples of anadromous fish species by site

Immune System Health Endpoint

The lowest hazard index for the immune system was 1.2 for spring chinook fillets at site 56 and the high was 70 for whole body Pacific lamprey at site. The highest hazard indices in fillet samples occurred for Pacific lamprey at Site 21, fall chinook salmon at Site 14, coho salmon at Site 30, and steelhead at Sites 96 and 48 (Figure 6-17). The highest hazard indices for whole-body samples occurred for Pacific lamprey at Site 21 and Site 24; coho salmon at Site 30; fall chinook salmon at Site 14 and Site 30, and steelhead at Sites 93, 96, and 48 (Figure 6-18).

Reproduction/Development Health Endpoint

The hazard indices for the reproduction/development health endpoint in anadromous fish species were similar to those for the central nervous system. The highest hazard indices in fillet samples occurred for spring chinook salmon at Site 56; steelhead at Sites 25, 56, 93, 96, and 48; fall chinook salmon at Site 14, and coho salmon at Site 30 (Figure 6-19). The highest hazard indices in whole-body samples occurred for steelhead at Site 93 and Site 96, Pacific lamprey at Site 24, coho salmon at Site 30, spring chinook salmon at Site 56, and fall chinook salmon at Site 14 and Site 48 (Figure 6-20).

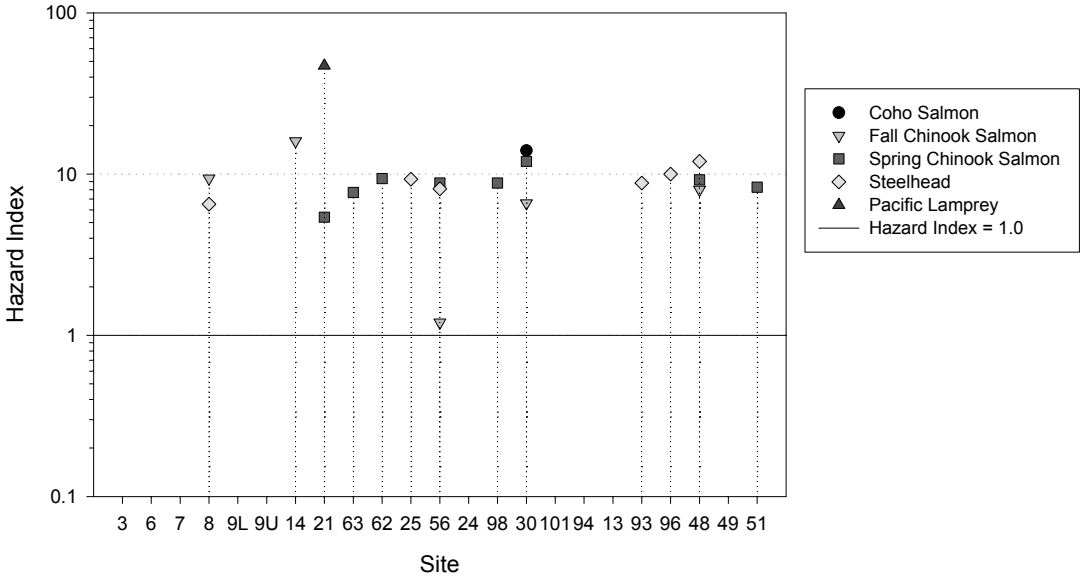

Figure 6-17. Hazard indices for the immune system health endpoint in fillet samples of anadromous fish species by site

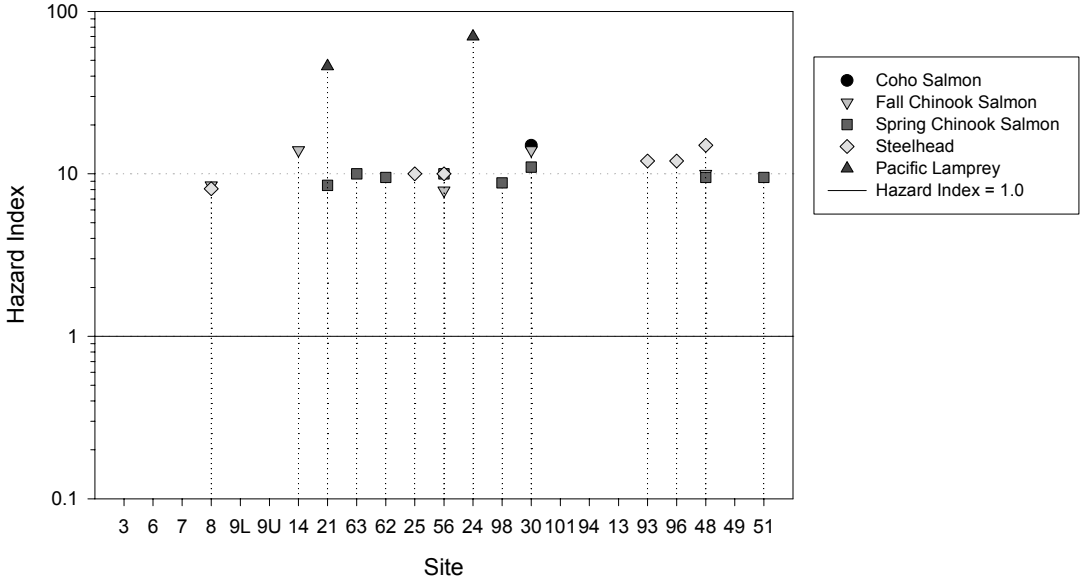

Figure 6-18. Hazard indices for the immune system health endpoint in whole body samples of anadromous fish species by site

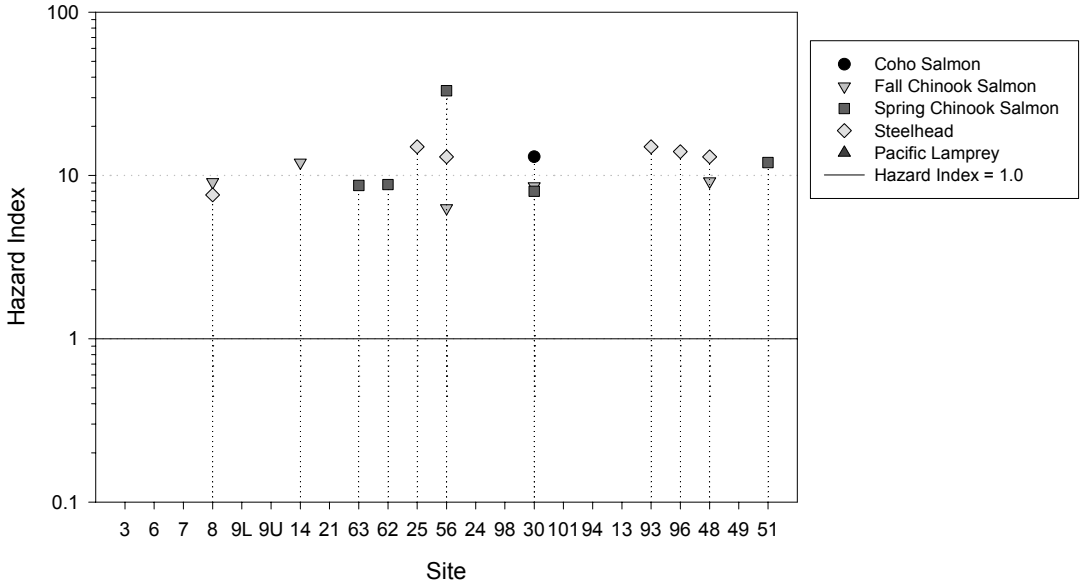

Figure 6-19. Hazard indices for the reproduction/developmental health endpoint in fillet samples of anadromous fish species by site

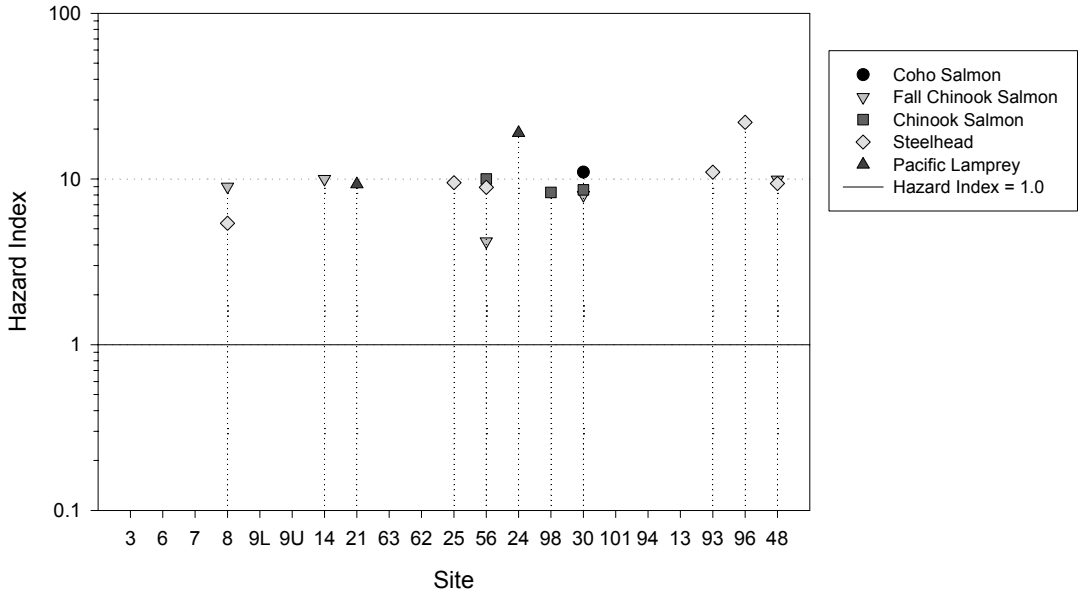

Figure 6-20. Hazard indices for the reproduction/development health endpoint in whole body samples of anadromous fish species by site